5.1

DEFINING UTILIZATION

Mark A. Shafer *
Oklahoma Climatological Survey, Norman, Oklahoma

1. INTRODUCTION

Much like the parable of the blind men and the elephant, when people speak of utilization, they may be describing different features. Utilization can range from reception of information to the information actually affecting some aspect of a problem which it sought to address. Both measures would be considered utilization, but the latter is much more difficult to achieve, and especially difficult to attribute changes to the source. Do we, as scientists, need to concern ourselves with whether or how the information is used? Is delivery of information to a decision-maker sufficient to consider our part as finished?

Utilization may also mean more than direct application of information by an individual. In addition to instrumental use there is conceptual use. This category encompasses much of the way scientific information is used. Conceptual use includes knowledge-driven, background information on a problem, to 'enlightenment' – analyses that create 'inventories of information' that alter subsequent debate, but do not have immediate impact. Neither necessarily changes immediate outcomes, but both have the capability to alter the policy environment in which decisions are made.

Scientists, and academics in general, have an additional barrier to overcome: the so-called cultural divide. Norms differ between researchers and practitioners, scientists and policy-makers. The scientific model of seeking objective truth may fall short within the problem-oriented, contextual, multi-disciplinary, and normative realm of decision-making. There are some factors that producers of scientific information can control, such as how information is presented, when it is made available, and additional context that addresses a problem. Tailoring information to address specific needs, within the context in which the decision-maker acts, can increase the likelihood that information will be used appropriately and effectively.

Thus, scientists must be aware of the target for which they are aiming. The way research and analyses are conducted and the way in which information is presented affects its use. Awareness of the multiple needs or opportunities for that information to influence both immediate needs and long-term issues will allow scientists to more effectively contribute to solving societal problems.

* *Corresponding author address:* Mark A. Shafer, Oklahoma Climatological Survey, 100 E. Boyd Street, Suite 1210, Norman, OK, 73019-1012; e-mail: mshafer@ou.edu.

2. USING SCIENTIFIC INFORMATION

The scientific community continuously monitors, forecasts, and researches our climate system. The culmination of this focus is a wealth of information available to decision-makers. However, sometimes this information is vague or contradictory. How does a decision-maker sort out the signal from the noise? Part of this begins with the intent of the study or paper. Matching the focus of the information to the needs of the decision-maker is a critical step.

Weiss (1979) shows that information use cannot always be easily identified. A study undertaken to better understand climate processes from a scientific standpoint, for example, may be of great value to the scientific community but of little value to decision-makers. On the other hand, a study aimed at a particular problem may meet the needs of decision-makers, but not measure up to the standards of the scientific community. Table 1 shows six different types of use of studies.

At one end of the spectrum is intellectual enterprise. These are the hallmark of many scientific studies, in which the goal is to understand a complex physical system and the target audience is the scientific community. These studies are valuable to advancing the state of knowledge, but as Weiss shows, they do not necessarily lead to immediate, tangible use by decision-makers. However, over time, the aggregation of knowledge may shape the definition of problems, thus leading to Weiss' 'Enlightenment' category. Each study contributes some bit of knowledge, and as the knowledge base grows, the environment in which the aggregate sum of knowledge is interpreted begins to change. One example of this process is in global climate change. The widely-held belief during the 1970s that the earth was cooling changed as new theories and evidence of global warming were accumulated. While global climate change is still the subject of much debate, the framing of the issue was distinctly changed during the following decade.

At the other end of the spectrum is instrumental use. As opposed to conceptual use, instrumental use seeks identifiable one-to-one relationships between an analysis and policy outcomes. This corresponds to Weiss' problem-oriented category, in which decision-makers have a specific, identified need and a study is performed to address those specific questions. An example of this is the National Academies of Sciences review of the IPCC reports for the Bush Administration. In this case, the Bush Administration submitted thirteen questions to the National Academies of Sciences, seeking their perspective on global climate change,

Intellectual Enterprise	Analysis undertaken to improve intellectual understanding of the process; not necessarily oriented toward application
Knowledge-Driven	Background information relating to a problem (rather than specific recommendations)
Problem-Oriented	Analysis undertaken to address a specific need
Enlightenment	Analysis creates 'inventories of information' that alter subsequent debate, but does not have an immediate impact
Political	Analysis used to justify a previously-made decision; report offers legitimacy but does not affect decisions
Tactical	An analysis is commissioned in order to delay a decision; report may never be read

Table 1: Types of Utilization (from Weiss, 1979).

measures of uncertainty, and the validity of global change models used in the IPCC reports. The Academy then assembled a panel, conducted a review of the state of knowledge on global climate change, and issued specific responses to each of the questions asked by the Administration. One tangible outcome of this process was a restructuring of global climate change programs within the Administration, to the point where senior administration officials are now involved in the issue.

However, instrumental use is not always clear-cut either. Use can range anywhere from a report being delivered to a decision-maker to actual changes in the problem which faces the decision-maker (e.g., Knott and Wildavsky 1980). Table 2 shows examples of what could be categorized as instrumental use. Part of the responsibility for use lies with the decision-maker, but those who produce the reports also bear responsibility for its use. Getting a report to the decision-maker does not assure that the information is going to be useful, or even acknowledged by the decision-maker. In order to reach the 'higher levels' of utilization, those who produce the reports must assure that the information meets the needs of the decision-maker and can be readily incorporated into the decision-making process. These early steps help to assure that the report will not only impact the single decision-maker, but will be cited in efforts to persuade others as well.

Getting a study to have influence in the decision-making process is more than a matter of conducting the study and letting the results 'speak for themselves.' Rather, results must be framed in the context of decision-maker needs. For a report to have an immediate impact, it must address problems facing one or more decision-makers. It must be framed in a manner consistent with other information from which the decision-maker is drawing. And lastly, it must be constructed in way that makes sense to the decision-maker and others whom she must persuade.

3. SCIENTISTS AND DECISION-MAKERS

Several factors compound utilization of scientific information. These factors include the often-differing perspectives of scientists and decision-makers, the nature of academic or research institutions, and the nature of reporting scientific results.

C.P. Snow (1964) characterized the division between scientists and what he termed 'the literary culture' as a vast chasm, across which communication ceased to exist. His examination of the patterns of thought between these two cultures showed a disparity in perspectives that contributed to misunderstanding, incomprehension, and distorted images of the other. Although differences existed among sub-cultures within each culture, the dominant culture constructed a shared perspective and methodology within the sub-cultures. Thus, scientists from different disciplines communicate among themselves more easily than did members of different cultures, even though they may be working on similar problems. Snow held a pessimistic outlook for the future because the gap precluded meeting points where "creative chances" occur. His conclusion was that creating understanding was more important than creating new scientific discoveries.

While others have argued that the cultural divide is not as dire as Snow described, others have concluded that some communication barrier remains between scientists and non-scientists (e.g., Stokes 1997). Morin (1993) saw the manifestation of this as scientists dis-engagement from politics; viewing political involvement as beneath them.

Reception	Decision-maker received a report; assumes that it is the analyst's duty only to produce the information
Cognition	Decision-maker received and read the report
Reference	Decision-maker changed her perspective as a result of the report
Effort	Decision-maker used the report to persuade others
Adoption	One or more of the report's recommendations adopted by a council or governing body
Implementation	Recommendations are incorporated into agency operations
Impact	Report changed some aspect of the problem which it sought to address

Table 2: Standards of Utilization (from Knott and Wildavsky, 1980).

These cultural differences have been extended more broadly to the academic community. Sabatier and Jenkins-Smith (1988) found a gap between researchers, in general, and government officials, which they termed the "two-communities". While perhaps not as deep as the gulf described by Snow, the two-communities division does create difficulties for scientific studies to be used in the policy process. However, Sabatier and Jenkins-Smith did find evidence that scientific studies follow the enlightenment model of utilization.

Other researchers have noted difficulties between researchers and practitioners (e.g., Sabatier 1978). In one of the earlier studies on the use of research, Cronbach and Suppes (1969) identified procedural differences that introduced barriers to utilization. The traditional model of research is conclusion-oriented, aimed at finding some objective truth. Policy needs, however, are focused more on decision-oriented inquiry, aimed at action. Webber (1992) noted that the policy environment relies upon subjective interpretation of data, not just objective analysis. This requires placing findings into the contextual environment in which decision-makers operate.

DeLeon (1988) characterized the policy environment as problem-oriented, contextual, multidisciplinary and normative. In contrast, scientific research is often divided into disciplinary fields, and often seeks objectivity. DeLeon's 'advice and consent' model suggests that policy is shaped by endogenous and exogenous factors – multiple disciplines and political events. These factors must be considered in order to place findings in a context favorable to utilization.

Even absent the barriers between scientists and decision-making communities, other factors influence the likelihood of a particular source of information being used by decision-makers. These factors include the dissemination source, the content or message, the dissemination medium, and the user (National Center for the Dissemination of Disability Research 1996).

The dissemination source is the agency or individual that creates the information or product. Information is more likely to be used by decision-makers if they perceive the source to be competent, credible, sensitive to their concerns, and have relationships toward others with whom the decision-maker works. Objective factors, such as experience, are important, but subjective perception of the source governs whether or not information is used.

The content involves the information itself, along with any supporting information or materials. Credibility again plays an important factor in utilization, but relevance to the decision-maker's needs is essential as well. Methodology, credible outcomes, and cost-effectiveness are some objective factors that affect utilization. In addition, the information must be understandable to users and must relate to existing information. Any particular study must compete with other information available to the decision-maker.

The medium is the way in which information is packaged and transmitted. Information that is available to the decision-maker in a timely fashion, is easy to access, and is 'attractive' is more likely to be used. Thus, the way in which information is presented is a critical factor governing the likelihood of selection by a decision-maker. This does not mean that the package is more important than the content, but a good study that is not designed to compete with other sources of information is less likely to be accepted by the decision-maker. In addition, dissemination media which are flexible, reliable, and cost-effective will become favored sources for a decision-maker, which assures information is available when the decision-maker needs it.

The last of these four dimensions is perhaps the most difficult to ascertain. Information selection depends

upon relevance to the decision-maker's needs, her capacity to use information – including resources, skills, and support – and the types of uses of information. For example, if a decision-maker wants to learn about a subject, she may seek a different source than when she is trying to persuade others to take some desired action. The information that was background material for her may not necessarily be useful for convincing others, especially if the decision-maker needed to invest a significant amount of time to process that information.

These barriers may seem formidable to a scientist seeking to influence the decision-making or policy process. Many of these barriers require training or support from outside of the scientific disciplines in order to promote utilization of results. However, as the earlier example of the Bush Administration's dealings with the National Academies of Sciences shows, bridging these barriers is not impossible.

4. DECISION-MAKING PROCESSES

Decision-makers face an array of complex problems. These problems involve variability in the physical world as well as variability in human behavior. Some elements may be easily identifiable and controllable, while other elements prove more intractable. In order to deal with the complexity of these processes, decision-makers adopt styles that allow them to process information in an orderly manner. Several examples of these processes are discussed below.

The 'textbook' image of decision-making is the rational model. According to the rational model, a problem is defined, evidence is collected, all options are evaluated, and the best option is selected. With regards to inclusion of scientific information, data – included in reports and studies available to the decision-maker – would be one of the foundations on which options were evaluated. Unfortunately, few instances of decision-making follow the rational model. In order to make decisions, the decision-maker would need complete information as well as know the actions of others.

One means of coping with the volume of information and limited time is what Simon (1947) called 'satisficing'. Some refer to this approach as the 'garbage-can model.' When faced with a problem, a decision-maker reaches into a 'garbage-can' and pulls out a solution. If the solution matches the problem and appears as if it will work, then the decision-making process is concluded. If the match is not good or expected outcomes unfavorable, another solution is tried, until a satisfactory outcome is identified.

Another common decision-making model is incremental adjustment. This approach seems commonplace, especially for areas where sweeping policy changes are not necessary. In this case, the decision-maker identifies key components of policies, and determines possible modifications to each. Each modification is then evaluated in the context of preferred outcomes, resources, and available information.

Decision-makers also sometimes simply 'borrow' alternatives from elsewhere (Walker 1981). This diffusion of ideas sometimes occurs through meetings, reports from other agencies or counterpart agencies in other states, or even through the media. While this approach may be easy, it runs the risk of incomplete information and incompatibility. There could be unique circumstances that affect the success of a program in one location that are not present in another location. Thus, copying a program in its entirety will not necessarily guarantee positive results. Also, the one 'borrowing' the alternative suffers from a lack of complete information. If a program needs to be adjusted for a new location, those adjustments may prove more difficult than the process of creating a new program.

One other way in which decision-makers deal with an array of information is through the structure of institutions (North 1990). The institutional model of decision-making follows the path of the rational choice model, but with several critical distinctions. First, institutions define credible sources of information, obviating the need for a single decision-maker to perform an exhaustive search. While there may not be formal stipulations on sources of information, there usually is common knowledge within the institution about where to seek information. Second, institutions structure the rules of the game. A decision-maker can, with reasonable confidence, anticipate how others will react to a decision. Third, institutions provide resources which lower transaction costs. Infrastructure that collects information makes it easier for a decision-maker to search what is available when faced with a decision.

With all of these different mechanisms by which decisions can be made, it becomes nearly impossible to prescribe a 'best approach' that favors inclusion of scientific information into the decision-making process. Yet all of these approaches do offer a few clues. First, establishing an organization as a credible source is important. Decision-makers will not likely look at sources with which they are unfamiliar. Stated another way, an alternative would not even be in the 'garbage can' unless it originates from a credible source. Second, promoting studies can be beneficial. If a decision-maker is borrowing alternatives from elsewhere, it is important to establish that similar information is already being used by another organization. Third, framing findings as alternatives to address some problem is necessary. Findings by themselves are not as likely to be used as are those that show a relationship to a problem.

5. PLACING INFORMATION IN CONTEXT

Any group that produces information, whether it be a scientific report, policy analysis, program evaluation, or an information packet targeted at legislators, seeks

instrumental use – those instances where a specific policy recommendation is adopted or a program change attributed to the findings from a report. Those instances are rare. Furthermore, focus on instrumental use leads one toward a rational model, whereas conceptual use incorporates a variety of other values (Weiss 1980). According to Weiss, conceptual use changes attitudes gradually and has a greater impact on policy than does instrumental use, which is usually relegated to small low-level decisions.

Scientists may not be able to control how information is used in the policy process, but they can be more involved in how that information is initially presented. By being aware of how findings relate to issues within policy communities, scientists can influence factors that will draw more positive attention to their work. Credibility is not only determined by the methodological rigor and the validity of findings; rather it depends upon ambiguity, corroboration with other sources or expectations, congruence with user goals, and users' opinions toward research (Sabatier 1978). Put simply, it is not sufficient to produce a good report with the usual caveats; it must be integrated into the ongoing issues discussions to which it pertains.

Even if these barriers can be successfully overcome, there may still be some hesitancy toward use of academic material in the policy process. Elected officials, and those whom they directly support (e.g., legislative staff), tend to view academic policy pieces with skepticism (Sabatier and Jenkins-Smith 1988). In the political world, there is no such thing as a neutral analysis. Every piece of information bears some policy preference. Usually these are known to decision-makers by attribution to the sources of information. However, academic reports often strive to be value-neutral, thereby masking underlying biases or preferences. Sabatier and Jenkins-Smith's solution to this "two communities" metaphor is to state positions up-front and to adopt an issue-advocacy approach to their work.

Information is most useful if it does not contradict too strongly with prior information. If information clarifies or resolves ambiguities, it is more likely to be accepted. Therefore, opportunities exist where there may be vague statutes, for example, in which policy-relevant information may clarify details of the policy or program.

The net result of the policy process is that there are many problems and many sources of information competing for the limited attention of policymakers (Hilgartner and Bosk 1988). If a researcher recognizes these limitations, one may find niches where policy-relevant information can be useful to decision-makers. These are most likely to occur in areas lacking strong conflict, and as close to the decision-maker as possible. Sweeping pronouncements for policy changes are not likely to be used, although they may eventually contribute to the discourse through enlightenment. The key, as DeLeon (1988) argues, is to aggregate information from multiple disciplines in a shared analytic framework. In other words, put the pieces together so that the decision-makers do not have to invest much time deciphering contradictory results from multiple studies.

6. SUCCESSFUL UTILIZATION

Such substantial barriers make utilization a daunting task. Nonetheless, the research community has figured out means to encourage utilization. Some of these are structural, such as institutional arrangements. Others are individual efforts. Most involve linking practical solutions to problems identified by the user community.

Several organizations that actively promote utilization include agricultural extension, the Natural Resource Conservation Service (NRCS), NOAA/OGP Regional Integrated Sciences and Assessments program (RISA), state climate offices and regional climate centers, and university-based outreach programs. These organizations have different success rates, but they share some common elements. First, the studies that they perform are mostly purposive. This includes Weiss' problem-oriented model as well as the knowledge-driven and enlightenment models. Research is often conducted aimed at addressing specific needs, such as developing drought-resistant crops, or may serve as background information for decision-makers.

A second common element is that all have as a goal changing individual user's practices. All of these organizations are aiming at Knott and Wildavsky's Impact standard, although effectiveness varies. All of the organizations cited here recognize that reception is not sufficient and that further interaction with those using the information is necessary to reach the higher standards of utilization.

The differences in effectiveness among the organizations cited here largely come down to the communication factors: dissemination source, content of the message, dissemination medium and user characteristics. With regards to source, key factors are that the organization is perceived as competent, credible, sensitive to the user's concerns and have developed relationships with others. In most cases, those who have interacted with each of these organizations would likely feel that this is the case. The biggest difference among the organizations is their relationships to others. Extension programs and NRCS offices that have existed for decades and are highly visible in local communities have these relationships, whereas the climate offices, outreach programs, and RISA centers do not have such a long history. On the local level, most agricultural producers know somebody who has benefited from using information from an extension office or NRCS office, but they are less likely to have encountered somebody who has benefited from interactions with a climate office or outreach program.

Regarding the content measure, information that was seen as relevant, understandable and cost-effective were key factors. All of these examples endeavor to package scientific or technical information in a way that meets these needs. A key factor in whether the information is seen as useful may be whether the information shows evidence of how it benefited another individual in a similar circumstance. This is not unlike the cost-effectiveness measure that policy-makers seek; an individual producer would want to see evidence of benefits before accepting risks of changing practices.

Dissemination medium is a difficult challenge for all types of organizations. The Internet has made information much more accessible, but it comes with the problem of information overload. An individual may go to any one of the examples citied here and obtain climate information. Each source will have differences in the way information is presented and what is included. Given such widespread access, users will tend to fall back on sources with which they are familiar and have a working history. Even though some will seek out information through the Internet, most still prefer direct contact and even printed materials. Utilization is best achieved if the organization has a direct, local presence, either through a physical infrastructure such as extension or NRCS offices, or training programs and workshops in local communities.

The last category, user characteristics, varies considerably across the clientele whom these organizations are attempting to reach. User skills and resources vary both between client groups and among individuals within a group. For example, some have identified an 'alpha producer' who is an early adopter of new information and technology. Other producers watch what this alpha producer does, and copies successful methods. Thus, information must be presented for a variety of levels; some more detailed for the early adopters and some more 'how to' guidance for those copying from others.

Within the applied climate community, the most successful efforts at implementing scientifically-based management practices come from direct, sustained contact with a progressive few individuals, with a diffusion process spreading information to a broader audience. Case-by-case applications of relevant information and products based on user-defined needs build the credibility needed to establish fledgling connections. Sustained training, workshops, software, and informational materials encourage use beyond the initial assistance. Finally, devoting resources to assure that contact is not just a one-time occurrence builds opportunities for collaboration that increase levels of utilization of climate information.

Two examples from the Oklahoma Climatological Survey (OCS) illustrate the processes involved in establishing credible connections to change behavior. One is within the realm of climate services, in this case monitoring drought conditions in Oklahoma. The second is an example of a successful outreach program for the emergency management community.

The climate services approach of building upon a single request-for-information is exemplified by interaction between OCS and the Oklahoma Water Resources Board (OWRB). During the drought of 1995-1996, OCS was contacted for an assessment of precipitation patterns in the state. OCS responded not only to the initial request, but developed routine assessments for the duration of the event. This helped OWRB to put the reported impacts into context of the ongoing climate variability and established OCS' credibility. Following the drought, sustained interaction over the years led to development of a website, with automated updates to maps and tables, designed in collaboration with OWRB staff (Arndt et. al. 2004). This allows OWRB timely access to assessments in a format which they can easily integrate into their agency operations and reports to other state agencies. Over the years, additional drought indices and models have been added to further facilitate drought management. What started as a set of maps and tables of precipitation departures for each climate division now contains the Standardized Precipitation Index (SPI), the Keetch-Byram Drought Index (KBDI), historical rankings for the period, and analog years. Thus, over time, OWRB water managers have become more technically savvy in using climate information because of the collaboration between the two organizations.

The outreach program example is OCS' OK-FIRST program for emergency managers (Morris et al. 2000). The program was developed in 1996 based upon a perceived communication barrier between sources of real-time weather information and local communities. The program provided a technical solution to address the barrier, but also required that each emergency manager who had access to the information participate in a training course. In the training course, the emergency managers learned some basic meteorological principles, how to correctly apply the radar and other weather information sources, and encouraged communication between the local offices and the National Weather Service Forecast Office during events. The training was highly successful, to the point that an independent evaluator noted that participants changed their behavior, and often their stature, within their local communities. The keys to success of the program were the training and ongoing follow-up interaction between participants and program staff. Each participant must attend a refresher course every 18 months, providing new opportunities for interaction, training, and feedback. In 2001, Harvard University recognized the OK-FIRST program with their Innovations in American Government Award, showing that the local emergency managers were more empowered to make decisions based on the information and support provided by the program.

Another example of linking the state of scientific knowledge to applications is through the RISA

programs. The CLIMAS program, for example, sponsors climate impacts research and integrates the findings into an information dissemination system. In order to understand the opportunities for applications of climate information, CLIMAS undertook a stakeholder assessment (Benequista and James 1998), in which interviews were conducted across the region to develop a framework for understanding climate information use, identify information gaps, and address constraints in applying climate information. This process established a foundation for understanding user needs, which subsequently allowed CLIMAS staff to tailor research, products, training and services to address these needs.

NRCS, agricultural extension and other climate offices and outreach programs share numerous similar success stories. The reason that these programs have succeeded in altering the decisions made by individuals in a variety of applications is that those involved in the organizations understood the needs, perspectives, and operations of the user. Staff endeavored to provide relevant research in a framework and format which matched the way in which the user conducted business, making information much more accessible and applicable. Sustained relationships were developed that enabled these organizations to become viewed as credible and reliable sources of information.

7. SUMMARY

So what does all this mean to the scientist who has conducted a study and wants to share some results? The bottom line is: conducting the study is only half of the challenge. Even the best results may not be considered by decision-makers if they do not fit within their framework or processes for making decisions. Structuring the output of a study requires targeting one or more specific decision-makers, knowing their needs, developing relationships to them, and understanding how they select and use information.

The first step to moving the study from findings to impact is to relate the findings to an identified (political) issue. Do decision-makers perceive a problem? What issues concern those decision-makers today? Framing the findings in terms of the pressing issues, as defined by the decision-makers themselves, increases the likelihood that the findings may have a direct impact. This requires moving from the intellectual-enterprise mode of most scientific studies to a problem-oriented study. This requires identifying those decision-makers who should act on this information and casting the findings in terms of what they individually identify as issues. A single study may not be sufficient; each decision-maker may have a different set of problems and the finding may need to be shaped to match each one individually.

Once the findings are matched to specific problems, it is necessary to shepherd the information through the different phases of utilization. First, individual decision-makers have to be identified, to whom the findings can be sent. This may be an organization's Director or CEO, a Division Chief, or front-line staff. Decentralized organizations provide multiple points of access to which information may be supplied that will then work its way upward through the organization, ultimately reaching the Director or CEO. Individuals tasked with certain areas of expertise, such as a drought coordinator in a state water agency, may be both receptive to information and influential within the organization.

Second, personal relationships need to be cultivated between the researcher and the identified decision-makers. Personal relationships encourage the use of information, improve communication channels, and facilitate recasting findings to match fluid situations. In this way, the researcher can become a resource as information is used, combined with other information, re-interpreted by the decision-maker or others, and as new questions arise. Building trust with smaller problems helps build credibility that will enable access when substantial policy issues emerge on the organization's agenda.

Third, information needs to be presented clearly within the context of the individual decision-makers' perspectives, including their responsibilities, backgrounds, and needs for information. Personal relationships help the scientist to understand perspectives and context, which will enable that scientist to fashion a more effective message.

If policies are passed, the researcher needs to monitor implementation, making sure that the new policies are indeed implemented and making it as easy as possible for those charged with implementation to understand the issue. Lastly, it may be necessary to broadly advertise the issue and new policies to affected communities. If the final end-user does not understand the problem, it is unlikely they will change their habits.

As a researcher shapes and reshapes the message and shepherds it through the system, it is important to be cognizant that the study is only one piece of a larger arena. Other studies, sometimes contradicting the original study, competing interests, costs of changing policies, and decision-makers' perspectives will have to be addressed in any final policy. The researcher should keep in mind that his study is only one element, and that it is highly unlikely that all recommendations will be accepted or implemented. Therefore, it is important to focus on one or two key factors and, as candidates for elected office are encouraged to do, 'stay on message.' Having a realistic perspective of the process helps the individual researcher to maintain a commitment while minimizing frustration.

The process of getting people who are in positions to change policies to act is difficult, but it is necessary for some members of the scientific community to be more broadly engaged. Over time, personal

relationships are established that facilitate the use of information from studies. Even if one single study does not garner much attention from decision-makers, it nonetheless may contribute to the 'inventories of information' which gradually change perspectives and in the end have a much greater impact that instrumental use.

REFERENCES

Arndt, Derek S., Mark A. Shafer and Kenneth C. Crawford, 2004: Drought and the Modernized Cooperative Observer Network. *14th Conference on Applied Climatology*. Seattle, WA: American Meteorological Society.

Benequista, Nicholas and Jennifer Schrag James, 1999: Pilot Stakeholder Assessment Report. Tucson, AZ: Institute for the Study of Planet Earth.

Cronbach, Lee J. and P. Suppes (eds.), 1969. Research for Tomorrow's Schools: Disciplined Inquiry of Education. New York: Macmillan.

deLeon, Peter, 1988: Advice and Consent: The Development of the Policy Sciences. New York: Russell Sage Foundation.

Hilgartner, Stephen and Charles L. Bosk, 1988: "The Rise and Fall of Social Problems: A Public Arenas Model," American Journal of Sociology, 94(1): 53-78
Knott, Jack and Aaron Wildavsky, 1980: "If Dissemination Is the Solution, What is the Problem?," Knowledge: Creation, Diffusion Utilization, 1: 421-442.

Morin, Alexander, 1993: Science Policy and Politics. Englewood Cliffs NJ: Prentice-Hall, Inc.

Morris, Dale A., Kenneth C. Crawford, Howard L. Johnson, Renee A. McPherson, Mark A. Shafer and J. Michael Wolfinbarger, 2000: OK-FIRST: an innovative information-support system for public-safety agencies. *2nd Symposium on Environmental Applications*. Phoenix, AZ: American Meteorological Society.

National Center for the Dissemination of Disability Research, 1996: A Review of the Literature on Dissemination and Knowledge Utilization. http://www.ncddr.org/du/products/review/

North, Douglass C., 1990: Institutions, Institutional Change and Economic Performance. New York: Cambridge University Press.

Sabatier, Paul A., 1978: "The Acquisition and Utilization of Technical Information by Administrative Agencies," Administrative Science Quarterly, 23: 396-417.

Sabatier Paul A. and Hank C. Jenkins-Smith, 1988: "Symposium on Policy Change: Editors Introduction", Policy Sciences, 21: 123-127.

Simon, Herbert A. 1947: Administrative Behavior; A Study of Decision-Making Processes in Administrative Organization. New York: MacMillan, Co.

Snow, C.P., 1964: The Two Cultures and a Second Look. New York: Cambridge University Press.

Stokes, Donald E., 1997: Pasteur's Quadrant: Basic Science and Technological Innovation. Washington D.C.: Brookings Institution Press.

Walker, Jack L., 1981: "The Diffusion of Knowledge, Policy Communities and Agenda Setting", in John E. Tropman, Milan J. Dluhy, and Robert M. Lind, eds., New Strategic Perspectives on Social Policy. New York: Pergamon Press: 75-96.

Webber, David J., 1992: "The Distribution and Use of Policy Knowledge in the Policy Process", in William N. Dunn and Rita Mae Kelly (eds.), Advances in Policy Studies since 1950. New Brunswick, NJ: Transaction Books, 383-418.

Weiss, Carol H., 1979: "The Many Meanings of Research Utilization," Public Administration Review, 39: 426-431.

Weiss, Carol H., 1980: "Knowledge Creep and Decision Accretion," Knowledge: Creation, Diffusion Utilization, 1: 381-404.

ACKNOWLEDGEMENTS

The concepts of utilization were presented to me by faculty members in The University of Oklahoma Department of Political Science. In particular, I would like to acknowledge Drs. Tom James and Cindy Rosenthal.